

1 **CLAIMS**

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3 1. A body protecting device for wearing by a user
4 comprising an array of energy absorbing cells,

5 wherein each cell comprises a tube,

6 and wherein substantially each tube has a side
7 wall which is near or adjacent to the side wall of
8 at least another tube,

9 and wherein substantially each tube is
10 configured such that the orientation of the tube is
11 substantially maintained when a load is applied
12 parallel to the axis of the tube.

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14 2. A body protecting device as claimed in Claim 1,
15 wherein the tube has a cylindrical or conical
16 structure.

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18 3. A body protecting device as claimed in Claim 1
19 or 2, wherein the body protecting device comprises a
20 safety helmet.

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22 4. A body protecting device as claimed in any
23 preceding claim, wherein substantially each tube has
24 a side wall which abuts the side wall of at least
25 another tube.

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27 5. A body protecting device as claimed in any
28 preceding claim, wherein substantially each tube has
29 a side wall which is connected to the side wall of
30 at least another tube.

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1 6. A body protecting device as claimed in Claim 5,
2 wherein substantially each tube has a side wall
3 which is connected to the side wall of at least
4 another tube by an adhesive.

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6 7. A body protecting device as claimed in Claim 5
7 or 6, wherein substantially each tube has a side
8 wall which is connected to the side wall of at least
9 another tube substantially along the length of the
10 tube.

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12 8. A body protecting device as claimed in Claim 5,
13 wherein substantially each tube has a side wall
14 which is welded or fused to the side wall of at
15 least another tube.

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17 9. A body protecting device as claimed in Claim 8,
18 wherein one or more tubes are formed from an inner
19 core comprising a first material and an outer core
20 comprising a second material.

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22 10. A body protecting device as claimed in Claim 9,
23 wherein the second material has a lower melting
24 temperature than the first material.

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26 11. A body protecting device as claimed in any
27 preceding claim, wherein substantially each tube is
28 near or adjacent to at least three other tubes.

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30 12. A body protecting device as claimed in any
31 preceding claim, wherein substantially each tube is
32 near or adjacent to six other tubes.

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2 13. A body protecting device as claimed in any
3 preceding claim, wherein each tube has a diameter of
4 between 2 and 8 mm.

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6 14. A body protecting device as claimed in any
7 preceding claim, wherein each tube has a diameter of
8 about 6 mm.

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10 15. A body protecting device as claimed in any
11 preceding claim, wherein the thickness of the side
12 wall of each tube is less than 0.5 mm.

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14 16. A body protecting device as claimed in any
15 preceding claim, wherein the thickness of the side
16 wall of each tube is between 0.1 and 0.3 mm.

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18 17. A body protecting device as claimed in any
19 preceding claim, wherein the length of each tube is
20 less than 50 mm.

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22 18. A body protecting device as claimed in any
23 preceding claim, wherein the length of each tube is
24 between 30 and 40 mm.

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26 19. A body protecting device as claimed in any
27 preceding claim, wherein the array of energy
28 absorbing cells is provided as an integral material.

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30 20. A liner for a body protecting device for
31 wearing by a user, the liner comprising:

1 a first material having an array of energy
2 absorbing cells, wherein each cell comprises a tube,
3 and wherein substantially each tube has a side wall
4 which is near or adjacent to the side wall of at
5 least another tube, and wherein substantially each
6 tube is configured such that the orientation of the
7 tube is substantially maintained when a load is
8 applied parallel to the axis of the tube.

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10 21. A liner as claimed in Claim 20, wherein the
11 body protecting device comprises a safety helmet.

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13 22. According to a third aspect of the present
14 invention, there is provided a body protecting
15 device comprising:

16 a first material bonded to a second material
17 using an adhesive, wherein the adhesive has a melt
18 temperature which is lower than the melt temperature
19 of the first and second material.

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21 23. The body protecting device of Claim 22, wherein
22 the first and second materials are in a softened
23 state at the melt temperature of the adhesive.

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25 24. The body protecting device of Claim 22 or 23,
26 wherein the first material is one of a
27 polycarbonate, polypropylene, polyetherimide,
28 polyethersulphone or polyphenylsulphone material.

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30 25. The body protecting device of any of Claims 22
31 to 24, wherein the second material is a plastics
32 material.

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2 26. The body protecting device of Claim 25, wherein
3 the second material is a fibre reinforced plastics
4 material.

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6 27. The body protecting device of any of Claims 22
7 to 26, wherein the adhesive is a thermoplastic.

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9 28. The body protecting device of Claim 27, wherein
10 the adhesive is a polyester based material.

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12 29. The body protecting device of any of Claims 22
13 to 28, wherein the melt temperature of the adhesive
14 is less than 180°C.

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16 30. The body protecting device of Claim 29, wherein
17 the melt temperature of the adhesive is between
18 120°C and 140°C.

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20 31. The body protecting device of Claim 30, wherein
21 the body protecting device is heated during forming
22 to between 155°C and 160°C.

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24 32. The body protecting device of any of Claims 22
25 to 31, further comprising a third material, wherein
26 the first material interposes the second and third
27 materials, and wherein the first material is bonded
28 to the third material using the adhesive.

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30 33. The body protecting device of any of Claims 22
31 to 32, wherein the first material has an array of
32 energy absorbing cells, each cell comprising a tube.

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2 34. A method of forming a body protecting device
3 comprising:

4 bonding a first material to a second material
5 using an adhesive, wherein the adhesive has a melt
6 temperature which is lower than the melt temperature
7 of the first and second material.

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9 35. The method of Claim 34, including selecting
10 first and second materials which are in a softened
11 state at the melt temperature of the first material.

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13 36. The method of Claim 34 or 35, including heating
14 the body protecting device during forming to between
15 155°C and 160°C.

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17 37. The method of any of Claims 34 to 36, including
18 bonding the first material to a third material using
19 the adhesive.

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21 38. The method of any of Claims 34 to 37, wherein
22 the first material has an array of energy absorbing
23 cells, each cell comprising a tube.

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